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(54) ELEMENT DE SECURITE DESTINE A UN DOCUMENT DE VALEUR OU A UN DOCUMENT DE SECURITE, COMPORTANT UN SYSTEME DE LAMELLES FRACTALES

(54) SECURITY FEATURE FOR A SECURITY DOCUMENT OR DOCUMENT OF VALUE WITH A FRACTAL LAMINATE SYSTEM

(57)

A security feature for security documents or documents of value, comprising a transparent body (2) provided with devices for representing graphical information according to an angle (18, 19, 20) between the direction of illumination and the direction of observation. Said devices consist of almost overlapping laminae (7, 8) arranged in the form of steps in said body (2). Preferably, the lamellae (7, 8) are fractally embodied and arranged in the body (2) in ascending order.

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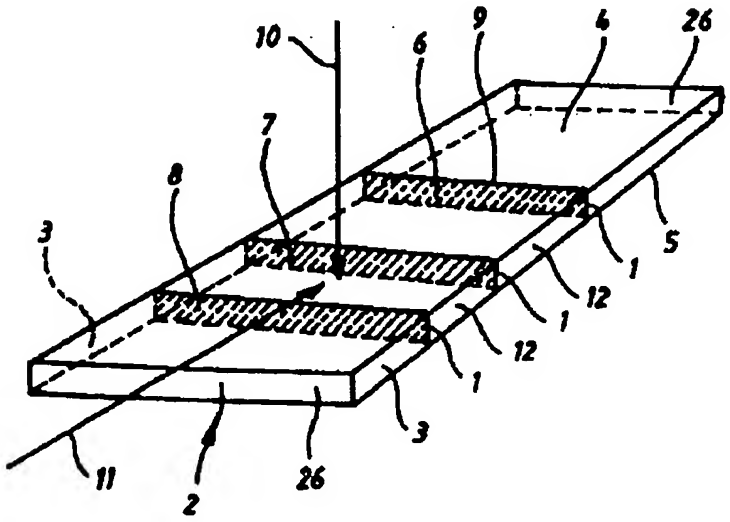
(54) **ELEMENT DE SECURITE DESTINE A UN DOCUMENT DE VALEUR OU A UN DOCUMENT DE SECURITE, COMPORTANT UN SYSTEME DE LAMELLES FRACTALES**

(54) **SECURITY FEATURE FOR A SECURITY DOCUMENT OR DOCUMENT OF VALUE WITH A FRACTAL LAMINATE SYSTEM**



(57) Elément de sécurité destiné à un document de valeur ou à un document de sécurité, comportant un corps transparent (2) pourvu d'unités qui représentent une information graphique en fonction de l'angle (18, 19, 20) formé entre la direction d'illumination et la direction d'observation. Ces unités comprennent des lamelles (7, 8) qui se chevauchent pratiquement les unes les autres et sont placées sous forme de gradins dans ledit corps transparent (2). Les lamelles (7, 8) se présentent de préférence sous forme fractale et sont placées de façon ascendante dans ledit corps (2).

(57) A security feature for security documents or documents of value, comprising a transparent body (2) provided with devices for representing graphical information according to an angle (18, 19, 20) between the direction of illumination and the direction of observation. Said devices consist of almost overlapping laminae (7, 8) arranged in the form of steps in said body (2). Preferably, the lamellae (7, 8) are fractally embodied and arranged in the body (2) in ascending order.

TRANSLATION

Security feature for a security document or document of value with a fractal laminate system

The invention relates to a security feature for security documents and documents of value according to the generic term of patent claim 1 as well as to a process for its production.

State of the art in the arrangement of security features in the case of security documents and documents of value are so-called multiplex holograms. It is a matter here of a hologram which from different viewing directions generates different images for the viewer. Further there are known so-called interference layers in foils or generally in transparent bodies. In such interference layers it is a matter of thin optical layers which generate angle-dependent graphic or color effects--according to the viewing angle.

Further, so-called variable displays are known; here it is a matter of lens arrays which can be arranged on a security document over print or security features and according to viewing direction generate on these lenses a different image depending on the viewing angle.

The disadvantages of the techniques mentioned are that holograms and interference layers can be represented only poorly under multifarious conditions of illumination. Furthermore, holograms and interference layers are wave-dispersive: i.e., here in the viewing there occur different color fringes in white light, depending on the viewing angle.

The aforementioned lens arrays require complicated production techniques and a certain, finite substrate thickness.

U.S. 3,887,742 shows a security feature for a document of value, namely a copying protection, which consists of a transparent foil, and within this foil there are provided obliquely arranged lamellae. These lamellae are made black or reflecting, and bring it about that information located underneath the security feature can be read out and in the other direction this information is not visible for the viewer. In this other direction the observer receives the graphic information of

the lamellae, namely transmitted black or reflecting.

DE 25 40 846 Al shows a protective coating for documents against copying in the form of a transparent film in which black lamellae are arranged obliquely.

A disadvantage of the forms of execution of the documents US 3,887,742 and DE 25 40 846 Al is that only a slight resolution is achieved and a relative great swing angle must first be run through in order to obtain an information change from "not see-through" to "see-through". These lamella structures, therefore, are only inadequately suited for the rapid and sure checking of security documents and documents of value, since they have a low resolution, and a relatively great swing angle has to be gone through, so that there is involved a time-consuming checking of the security documents and documents of value.

Underlying the invention, therefore, is the problem of further developing a security feature of the type mentioned at the outset so that under different viewing angles different graphic information data can be generated in a simpler and more economical manner.

For the solution of the problem posed the invention is characterized by the technical teaching of claim 1. 1

For the solution of the problem posed, the invention is characterized by the technical teaching of claim 1.

An essential feature of the invention is that in a transparent body there are arranged lamellae nearly overlapping one another, which, increasing about stepwise, fill out the cross section of the body. Fractally increasing lamellae are preferred.

Underlying the invention, therefore, is the insight that a transparent substrate is subdivided by a nontransparent laminate system, and namely in such manner that the substrate appears transparent with a certain viewing direction upon the substrate, while, if the viewing direction is changed, the nontransparent laminate system becomes visible and prevents a looking through the substrate.

If, with unchanging viewing direction the substrate is rotated under the eye, the substrate appears transparent or black according to the turning, because in the case of blackening the nontransparent laminate system with its non-transparent lamellae, prevents a view through the substrate.

According to the turning of the substrate, therefore, a light-and-dark effect is generated.

In a further development of the invention it is provided that not every lamella forms a straight line on its side edge, but each lamella is divided into a large number of part-lamellae increasing in step form one after another, so that, therefore, fractal lamellae are created, which fill the cross section of the substrate.

With the subdivision of the laminate system into fractal lamellae there is yielded, namely, the advantage that the switchover of the light-dark principle (look-through vs. black) occurs abruptly; i.e. if the lamellae are released with a correspondingly high iteration stage, it is therewith ensured that in a rotation of this substrate an abrupt switchover from light to dark

occurs--i.e. from one graphic element to another. In the ideal state, therefore, there are no intermediate stages when a sufficiently high iteration stage occurs in the resolving of individual lamellae into fractal sub-lamellae.

In the above it was indicated that with the arrangement of fractal lamellae such a transparent substrate can be of such nature that during a total observation value of a certain observation angle of, for example 90° it appears fully transparent, and that then a sudden switchover occurs and from this switchover angle onward the substrate in further turning no longer appears transparent.

There is, therefore, for example, in the ideal case an angle from 0° to 90° where the substrate appears transparent, while at an angle of from 91° to 180° the substrate still appears only dark.

In a further development of the technical teaching according to the present invention it is provided that in such a transparent substrate there is present not only a single laminate system which ensures this light-to-dark switchover and therewith is in a position to deliver this light-dark information, but that in this substrate there are present several laminate systems which cooperate.

As was stated earlier there is a range from 0° to 90° where the first laminate system is transparent. If one now arranges a second laminate system in the substrate so that in this range--where the first laminate system appears open and transparent, the second system appears nontransparent, then over this viewing angle from 0_o to 90° there can be represented altogether two different graphic informations, namely the graphic information of the first laminate system (which is bright) and in which in this bright state the graphic information of the second laminate system appears dark when one looks through the substrate with the viewing angle from 0° to 90° remaining constant.

These laminate systems can be arranged next to one another and/or over one another. They can

cover each other, or be present in separate zones.

Above it was merely stated that light-and-dark graphics can be generated when it is possible to subdivide a linear lamella into individual fractally subdivided individual lamellae. It is obvious that with the present invention not only light-and-dark informations can be conveyed, but it can be provided that instead of the subdivision of a single linear line course (single lamella) there can also be fractally subdivided a letter consisting of individual line strokes. This leads now to the result that at a first viewing angle there becomes visible the substrate transparent per se, for example, of the letter A in the interior of this substrate and that with increasing rotation of the substrate into another viewing angle the letter A abruptly disappears and the letter B pops up. This is achieved exclusively by the overlapping and by the integration of two different laminate systems in the transparent substrate.

The laminate system of the invention is suited for use in transmitted light and/or incident light.

The object of the present invention is yielded not only from the object of the individual patent claims, but also from the combination of the individual patent claims among one another.

All the indications and features disclosed in the documents, inclusive of the abstract, especially the spatial construction represented in the drawings, are claimed as essential to the invention insofar as they are novel individually or in combination with respect to the state of the art.

In the following the invention is explained in detail on the basis of drawings which represent only one course of execution. Here there proceed from the drawings and their description further features essential to the invention and further advantages of the invention.

In the drawings:

Fig. 1 shows schematically a substrate with a simple laminate arrangement with non-fractal subdivision;

Fig. 2 a substrate modified with respect to Fig. 1, with a fractal subdivision of lamellae;

Fig. 3a the representation of a continuous linear segment which forms the side edge of a lamella according to Fig. 1:

Fig. 3b: the subdivision of a continuous linear segment which forms the side edge of a lamella according to Fig. 1;

Fig. 3c: the subdivision of the linear strokes according to Fig. 3b under doubling of this angle;

Fig. 3d: the subdivision of the linear course according to Fig.3c under tripling of the angle;

Fig. 4: in schematized form a representation of the light-to-dark switchover on change of the viewing direction.

Fig. 1 shows a substrate, i.e., therefore, a transparent body 2 which shows altogether three lamellae 6, 7, 8 (arranged crudely with spacing next to one another). The body has here two lengthwise sides 3 spaced from one another and at a 90* angle from these there are arranged here the narrow sides 26. The body is further defined by an upper cover surface 4 and a lower cover surface 5. It is a matter, therefore of a body 2 of about plate form, which is to be transparent.

In the interior of the body there are now arranged lamellae 6, 7, 8 parallel to one another, which form between them interspaces 12, 13.

Each lamella is defined by a lengthwise edge 9, which runs about parallel to the lengthwise edge of the narrow sides 26, and otherwise the surface of each lamella 6 to 8 also runs parallel to the

narrow sides 26 of this plate-form body. The narrow sides of each lamella are defined in each case by a line segment 1, which runs about parallel to the narrow sides of the body.

If one looks now through this transparent body in arrow direction 10, then one sees through the interspaces 12 between the lamellae 6, 7, 8, because the lamellae themselves are not visible in this direction and the body appears transparent.

If, however, one looks at the body 2 in arrow direction 11 (or in opposite direction to this), then the non-transparent lamellae 6, 7, 8 prevent a viewing through the body: the body appears block. In correspondence to the viewing direction, therefore, a light-and-dark information can be transmitted which depends on the position of the lamellae and the number of them, etc.

If one now subdivides a line segment 1 according to Fig. 3 into several line segments lb according to Fig. 3b, then this line segment 1 is transformed.

Underlying the invention is the insight that with (fractal) lamella systems surprising projection properties can be realized. A fractal lamella system (laminate system) arises through the repeated application of a transformation onto a line segment 1. As an example, Fig. 3a shows a laminate system which arises through repeated division of a line segment 1 into N parts and rotation about an angle θ. Figs. 3b to 3d show different iteration stages of the construction. Despite the ever finer-becoming subdivision of the lamellae, the depth (D) required for the laminate system does not increase significantly. The laminate system from Fig. 3d is very nearly impermeable to light for all angles between 0° and +90° and is permeable to light for all angles between 0° and -90° (see Fig. 4). For a small angle θ and a large N the deviations from "impermeable to light" and "permeable to light" with increasing iteration degree approach zero. From such fractal lamellae there can be constructed images which appear and disappear at sharply defined angles. It is mathematically proven that fractal laminate systems can be constructed, the parallel projection of which from every spatial angles yields a desired image for this spatial angle.

The laminate systems can be exposed, inscribed, imprinted, extruded, mechanically generated (bored) into a substrate or be realized in similar processes. They can be designed for observation in transillumination or incident illumination (rear side illumination or reflection). By suitable choice of the colors of substrate and lamellae the security feature can be executed in color.

Advantages of the invention over the state of the art:

- Astonishing, clearly verifiable effect.
- the "reading-out" of the structure of the laminate system is very difficult.
- The resetting of the laminate system is still more difficult.

In a further development of the present invention it is provided that several layers of such laminate systems are present in panes of different depth of the substrate, and likewise it is provided that the angle-dependent graphic effect is visible in the transmitted light.

Likewise in can be provided in another form of execution that the angle-dependent graphic effect is visible in incident light.

Fig. 2 shows the application of the fractal lamellae 14, 15, 16, 17 in a substrate according to Fig. 2.

There it is perceptible that the lamellae 14-17, with formation of interspaces 12, 13 are arrayed tightly and stagewise as well as in step form on one another, in which arrangement the interspaces 12, 13 permit a viewing through these fractal lamellae when the body 2 is viewed from above in the zone between the arrow directions 11-22, in contrast, the body 2 appears dark.

In Fig. 3b it is further explained that the angle that is provided with reference symbols 18,. and

the angle 19 according to Fig. 3c is doubled with respect to the angle 18, where, however, the angle 20 in Fig. 3d is tripled with respect to the angle 18.

In Fig. 4 it is schematically represented that, in dependence on the viewing direction 23, there is a light zone 24 in the angle range from +90° to 0°, and likewise a dark zone 25 in the angular range from 0° to +90°.

With the given technical principle, therefore, security features can very well be produced secure against falsification, for such security features can very easily be integrated into security documents and value documents. Such a transparent body can be arranged in a window-type cutout of such a security document and value document and can be viewed either in transmitted or in incident light.

Legends for drawings 1

1. Line segment 16
2. Body
3. Lengthwise side
4. Cover surface
5. Cover surface
6. Lamella
7. Lamella
8. Lamella
9. Longitudinal edge
10. Arrow direction (illumination direction)
11. Arrow direction (dark zone)
12. Interspace
13. Interspace
14. Fractal lamella
15. Fractal lamella
16. Fractal lamella
17. Fractal lamella
18. Angle
19. Angle
20. Angle
21. Arrow direction (light (or bright) zone)
22. Arrow direction (switchover (or transition) zone)
23. Viewing direction
24. Light (or bright) zone
25. Dark zone
26. Narrow side

TRANSLATION

Patent Claims

Security feature for security documents or documents of value with a transparent body (2) which is provided with arrangements which represent a graphic information in dependence on the angle between illumination direction and observation direction, these arrangements consisting of lamellae (6-8; 14-17) nearly overlapping one another), which are arranged in the body (2) about in step form, characterized in that each of the lamellae (6-8, 14-17) is again divided fractally into a plurality of step-form part lamellae or sub-lamellae.

2. Security feature according to claim 1, characterized in that the lamellae (14-17) and/or part lamellae or sub-lamellae are arranged in the body (2) rising successively over the body thickness (D)

3. Security feature according to one of claims 1 or 2, characterized in that several layers of lamellae (14-17) are arranged one over another in the body (2).

4. Security feature according to claim 3, characterized in that the layers of lamellae (14-16) stand at an angle to one another.

5. Process for the production of a security feature according to one of the preceding claims with the following steps:

- Readying of a transparent body (2),
- Impressing of a lamella structure into the body (2) along a line through light, stamping, coating or a mechanical treatment, in which an individual lamella is fractally subdivided into further part- or sub-lamellae.

6. Process according to claim 5, characterized in that laser light is used.

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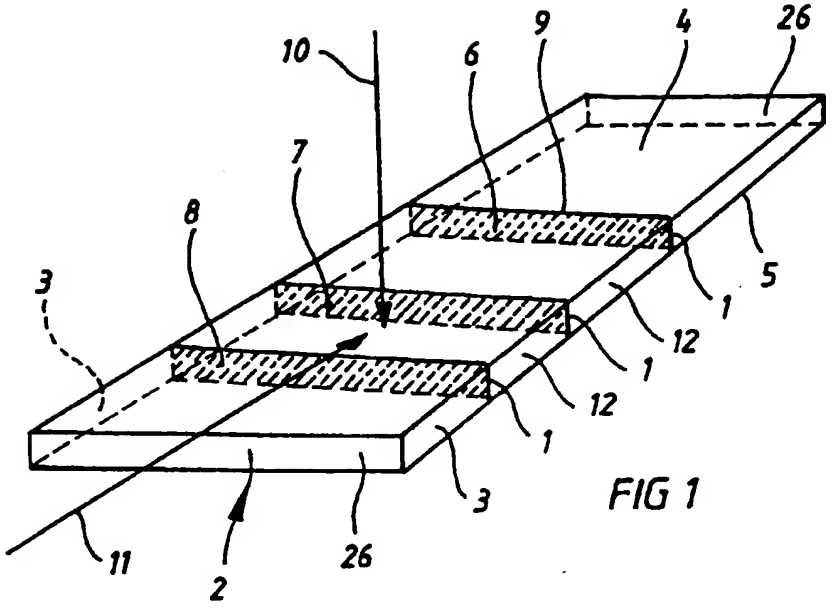


FIG 1

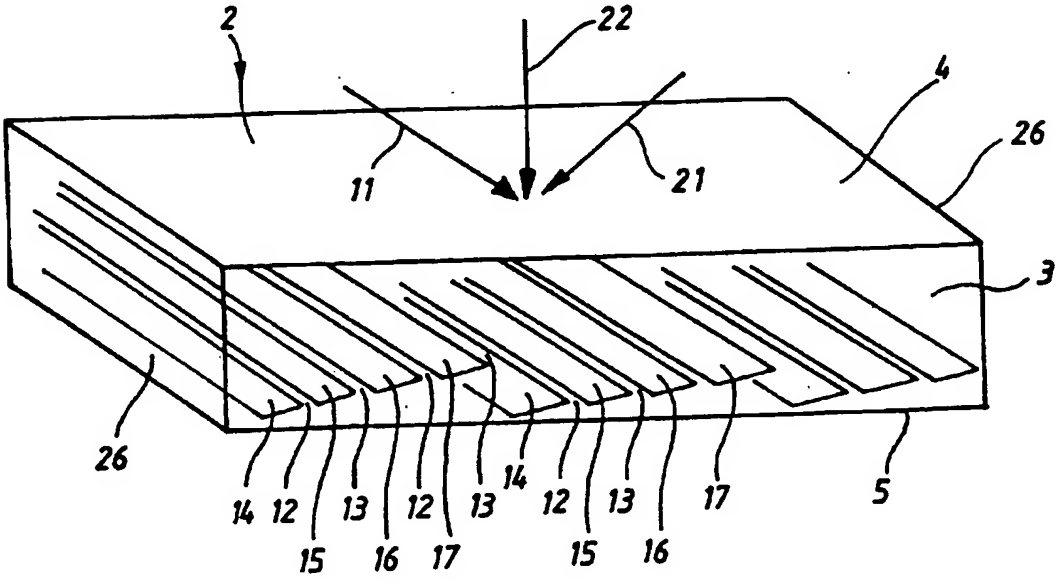
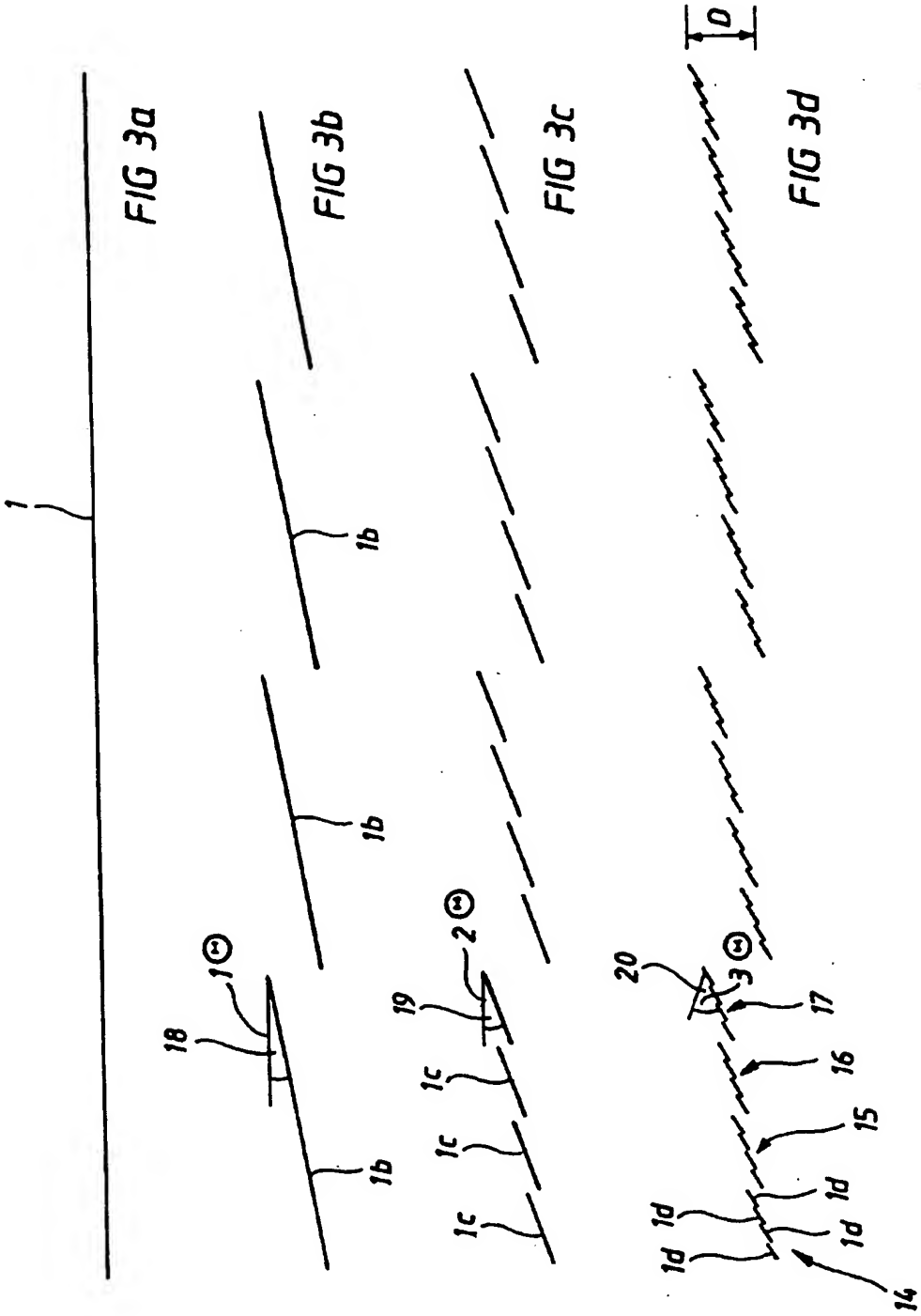


FIG 2



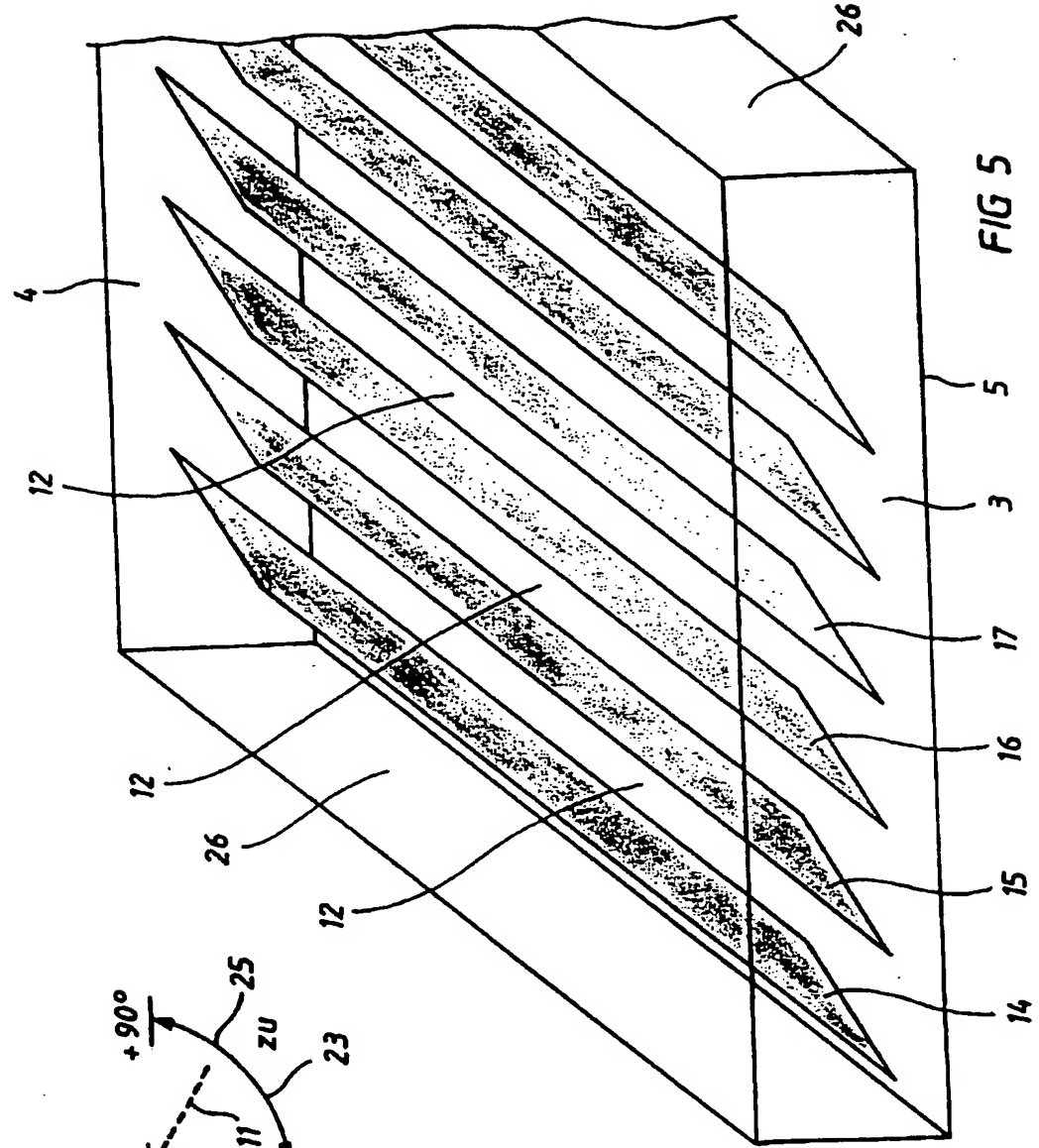


FIG 5

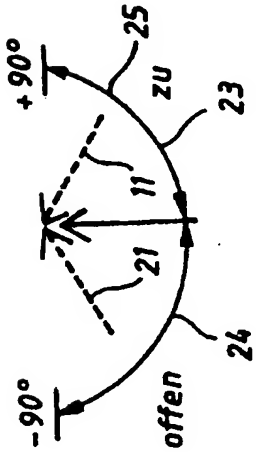


FIG 4

PCT WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro
INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

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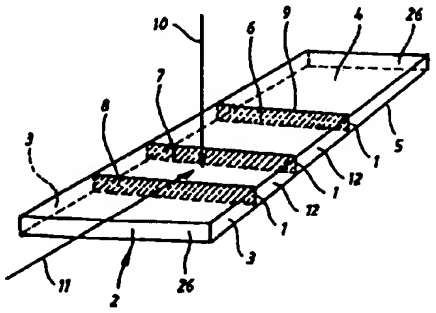
(54) Title: SECURITY FEATURE FOR A SECURITY DOCUMENT OR DOCUMENT OF VALUE WITH A FRACTAL LAMINATE SYSTEM

(54) Bezeichnung: SICHERHEITSMERKMAL FÜR EIN WERT- ODER SICHERHEITSDOKUMENT MIT FRAKTALEM LAMELLENSYSTEM

(57) Abstract

A security feature for security documents or documents of value, comprising a transparent body (2) provided with devices for representing graphical information according to an angle (18, 19, 20) between the direction of illumination and the direction of observation. Said devices consist of almost overlapping laminae (7, 8) arranged in the form of steps in said body (2). Preferably, the lamellae (7, 8) are fractally embodied and arranged in the body (2) in ascending order.



(57) Zusammenfassung

Sicherheitsmerkmal für Wert- oder Sicherheitsdokumente mit einem transparenten Körper (2), der mit Einrichtungen versehen ist, die in Abhängigkeit von dem Winkel (18, 19, 20) zwischen Belichtungs- und Beobachtungsrichtung eine graphische Information darstellen, wobei diese Einrichtungen aus sich einander nahezu überlappenden Lamellen (7, 8) bestehen, die in dem Körper etwa treppenförmig angeordnet sind. Die Lamellen (7, 8) sind bevorzugt fraktal ausgebildet und ansteigend in dem Körper (2) angeordnet.